2 EXPLOSIVES

2.1 Analytical Approach

2.1.1 Perform a detailed physical exam. Based upon these observations, the examiner will decide which analytical procedures will be used.

2.1.2 Document using an Explosives Worksheet (Appendix 19). Second and subsequent pages of documentation shall be recorded on 8 ½ X 11 inch lined paper.

2.1.3 If unconsumed low explosives powder is present, proceed to ¶ 2.4, Analysis of Unconsumed Low Explosives Powder.

2.1.4 If unconsumed pyrotechnic (fireworks) powder is present follow the procedure for the analysis of unconsumed low explosives powder but add SEM-EDS.

2.1.5 If no unconsumed powder is present/identified, proceed with extractions in the following order:

2.1.5.1 Methanol extracts monomethylamine nitrate (MMAN). If water gel explosives are not suspected, this step may be omitted.

2.1.5.2 Ether extracts nitroglycerin (NG). Use only when nitroglycerin identification or comparison is needed when double-base smokeless powders are suspected.

2.1.5.3 Acetone extracts organic explosives, most notably nitrocellulose (NC).

2.1.5.4 Water extracts inorganic explosives.

2.1.5.5 Toluene extracts free sulfur. (Optional)

2.1.5.5.1 Allow the material being extracted to dry thoroughly between extractions.

2.1.5.5.2 Remove a portion of the water extract for IC analysis, if appropriate.

2.1.5.5.3 Perform microchemical and instrumental analysis on the extracts themselves or the dried residue from the extractions.

2.1.6 Any remaining extract and/or extracted residue is retained and returned in the item container corresponding to that particular item, unless otherwise indicated.

2.1.7 Microchemical results generally are noted on the Explosives Worksheet. Instrumental results are compared to known standards and/or standard data files, and are retained in the case file.

2.1.8 Chemical reaction devices are a unique subset of improvised devices which are discussed in a separate section. (¶ 2.3)

2.1.9 **Safety Considerations: The utmost caution is required when handling explosive materials and devices.**

2.1.9.1 Explosive devices must be dismantled or rendered safe before submission. If a live device is encountered, safely secure it and the laboratory area, notify the appropriate supervisory staff and call the submitting agency for immediate removal from the laboratory.

2.1.9.2 If there are any questions regarding the stability of an explosive or its safety, notify the appropriate supervisory staff who may need to contact the nearest bomb disposal unit.

2.1.9.3 Analyze only small quantities of material.

2.1.9.4 Do not work near sources of heat or fire.

2.1.9.5 Do not subject material to violent shocks.

2.1.9.6 Store material away from heat, fire and other explosives or accelerants.

2.1.9.7 Dynamite can be desensitized by adding water or acetone to it.

2.1.10 Minimum Standards and Controls

2.1.2.1 Reagent reliability checks will be performed using the known materials specified in Appendix 4 and recorded on the Explosives Worksheet.

2.1.2.2 Solvents used for extraction must be of the following purity or better:

- Methanol – HPLC grade
- Acetone – Certified ACS grade or reagent grade
- Toluene - Certified ACS grade
- Deionized water

2.1.2.3 Solvent blanks must be run with each case extracted.

2.2 Physical Examination

2.2.1 Purpose

The purpose of the physical examination is to observe, document and recover materials for analysis. In addition to other materials, the search includes recovery of any unconsumed explosives powder. The information derived from this examination is necessary for determining the appropriate analytical procedure. It may also be beneficial to the submitting agency in providing investigative direction.

2.2.2 Analytical Procedures

2.2.2.1 If a fingerprint examination is requested, handle evidence with gloves or forceps.

2.2.2.2 Note type of material present, e.g., cardboard, plastic, paper, pipe, metal, etc.

2.2.2.3 Record approximate measurements of any devices.

2.2.2.4 Examine evidence for damage by violent force. If fragments are present, note size and shape. Note the presence of threaded fragments and end caps.

2.2.2.5 Determine the means of ignition, if possible, by examining evidence for the presence of fuse holes, fuse material, blasting caps and leg wires or electrical circuitry.

2.2.2.6 Using the stereomicroscope, and/or illuminated magnifier, search the device and/or fragments for particulate or powder material and preserve for further analysis.

2.2.2.7 Note any paint or markings. This can include letters, designs, or color-coded marks.

2.2.2.8 Record observations on worksheet or in notes.

2.2.3 References

2.2.3.1 Yallop, H.J., Explosion Investigation, The Forensic Science Society & Scottish Academic Press, Harrogate, England and Edinburgh, Scotland, 1980.

2.2.3.2 Saferstein, Richard, Criminalistics: An Introduction to Forensic Science, ed. 2, Prentice-Hall, Inc.: Englewood Cliffs, NJ, 1981.

2.3 Analysis of Chemical Reaction Bombs

2.3.1 Purpose

2.3.1.1 The purpose of analyzing chemical reaction bombs is to determine the composition of the components of what is most commonly an acid/base bottle bomb.

2.3.1.2 Physical indications of a device that functioned in the absence of any chemical residue may indicate a dry ice (carbon dioxide) bottle bomb.

2.3.2 Analytical Procedures

2.3.2.1 Note condition of the container, e.g., ruptured, distorted, capped, uncapped, and the condition of any foil present, e.g., strips, balls, twists.

2.3.2.2 Follow the General Chemical Procedure for Acids and Bases in ¶ 8.1.

2.3.2.3 Analyze recovered liquid or water extracts by IC and SEM-EDS.

2.3.2.4 Analyze intact or partially consumed “aluminum” foil by SEM-EDS.

2.4 Analysis of Unconsumed Low Explosive Powder

2.4.1 Purpose

The purpose of analyzing unconsumed low explosive powder is to determine its chemical composition for identification purposes. This is generally applicable to black powder, black powder substitutes, smokeless powder and flash powders.

2.4.2 Analytical Procedures

2.4.2.1 If any unconsumed powder is recovered from an expended device, no extractions will be performed unless there is an indication of a mixture of filler materials from the examiner’s observations or information derived from the RFLE.

2.4.2.2 Weigh the powder, unless trace amount. Alternatively, if there are only a few particles of unconsumed powder present, instead of weighing, count the particles and make a note of how many particles are consumed during analysis.

2.4.2.3 Describe the physical appearance of the powder.

2.4.2.4 Perform an ignition test on the powder, ¶ 2.7.

2.4.2.5 Perform microchemical tests on the powder, ¶ 2.6.

As a minimum:

- If suspected smokeless powder- DPA
- If suspected black powder or black powder substitute- DPA, Triphenylselenium chloride (while supplies last), Ascorbic Acid Strip
- If suspected flash powder or pyrotechnic mixture- DPA, Triphenylselenium Chloride (while supplies last), Aqueous Aniline Sulfate

2.4.2.6 Perform FTIR instrumental analysis on the powder, utilizing one of the following sample preparation techniques:

- KBr
- The microcompression cell with diamond windows
- From acetone in reflectance mode on a mirrored slide
- From acetone on KBr in transmittance mode

2.4.2.7 In lieu of FTIR, XRD may be used for powders other than smokeless powder.

2.4.2.8 If a comparison of powders is requested, additional steps are necessary.

2.4.2.8.1 Measurements of the dimensions of smokeless powders will be recorded. For other powders, determine the approximate grain size.

2.4.2.8.2 The comparison will include minimal microchemical tests and the ignition test as described in the above procedure.

2.4.2.8.3 Smokeless powders should be screened using either TLC or GC and the patterns/components between the samples compared to determine their similarities or differences. If similar, GC-MS should be used to identify the components and compare the patterns. If difficulties are experienced with the GC-MS analysis, an ether extract for NG and an acetone extract for NC may be analyzed using FTIR.

2.4.2.8.4 For other powders, a comparison of the results of IC, SEM-EDS and XRD testing should be conducted.

2.4.3 References

2.4.3.1 Parker, R.G., McOwen, J.M., and Cherolis, J.A., "Analysis of Explosives and Explosive Residues. Part 2: "Thin-Layer Chromatography", Journal of Forensic Sciences, Vol. 20, No. 1, April 1975, pp. 254-256.

2.5 Extractions

2.5.1 Methanol Extraction

2.5.1.1 Purpose

The purpose of a methanol extraction is to remove any monomethylamine nitrate present in the material being extracted.

2.5.1.2 Minimum Standards and Controls

2.5.1.2.1 Previously cleaned glassware is rinsed with methanol.

2.5.1.2.2 A methanol blank must be run at the same time as the debris extract. The same volume of methanol used for extraction of the debris should be used for the blank; and the blank should be reduced to the same volume. This blank is compared to the extract from the debris.

2.5.1.2.3 If the sample extract is to be filtered, the blank will be filtered in a like manner.

2.5.1.2.4 If the sample is to be evaporated, the blank is evaporated a like amount.

2.5.1.3 Analytical Procedures

2.5.1.3.1 Rinse the material being extracted with methanol in the areas where residue is observed/suspected.

2.5.1.3.2 Filter the methanol extract, if necessary, using filter paper or a Pasteur pipette with a plug of glass wool inserted into it.

2.5.1.3.3 Decant the methanol into an evaporating dish or beaker and concentrate to several milliliters. Sodium sulfate can be used to remove water from the sample if necessary.

2.5.1.3.4 Transfer to a labeled sample vial.

2.5.1.3.5 Analyze extract using the appropriate instrumentation.

2.5.1.4 References

2.5.1.4.1 Saferstein, Richard, Criminalistics: An Introduction to Forensic Science, ed. 2, Prentice-Hall, Inc.: Englewood Cliffs, NJ, 1981.

2.5.1.4.2 Yinon, Jehuda and Zitrin, Shimuel, Modern Methods & Applications In Analysis of Explosives, John Wiley & Sons, Inc.: NY, NY, 1993.

2.5.1.4.3 Parker, R.G., “Analysis of Explosives and Explosive Residues. Part 3: “Monomethylamine Nitrate”, Journal of Forensic Sciences, Vol. 20, No. 2, April 1975, pp. 257-260.

2.5.2 Ether Extraction

2.5.2.1 Purpose

The purpose of an ether extraction is to remove any nitroglycerin from the material being extracted.

2.5.2.2 Safety Considerations

2.5.2.2.1 Ethyl ether is a very volatile and highly flammable liquid. Do not use near a flame.

2.5.2.3 Minimum Standards and Controls

2.5.2.3.1 Ether is ″washed″ with deionized water (to remove any alcohol).

2.5.2.3.2 Previously cleaned glassware is rinsed with ether prior to use.

2.5.2.3.3 A solvent blank must be run at the same time as the debris extract. The same volume of ether used for extraction of the debris should be used for the blank; and the blank should be reduced to the same volume. This blank is compared to the extract from the debris.

2.5.2.3.4 If the sample extract is to be filtered, the blank will be filtered in a like manner.

2.5.2.3.5 If the sample extract is to be evaporated, the blank will be evaporated a like amount.

2.5.2.4 Analytical Procedure

2.5.2.4.1 Rinse the material being extracted with ether in the areas where residue is observed/suspected.

2.5.2.4.2 Filter the ether extract, if necessary, using filter paper or a Pasteur pipette with a plug of glass wool inserted into it.

2.5.2.4.3 Decant the ether into an evaporating dish or beaker and concentrate to several milliliters.

2.5.2.4.4 Transfer to a labeled sample vial.

2.5.2.4.5 Analyze extract using appropriate instrumentation.

2.5.3 Acetone Extraction

2.5.3.1 Purpose

The purpose of an acetone extraction is to remove any organic explosives, most notably nitrocellulose, from the material being extracted. Note: Chloroform can be substituted for acetone on wet samples.

2.5.3.2 Safety Considerations

2.5.3.2.1 Acetone is a very volatile and highly flammable liquid. Do not use near a flame.

2.5.3.3 Minimum Standards and Controls

2.5.3.3.1 If necessary, filter through a drying agent (such as sodium sulfate) to remove excess water.

2.5.3.3.2 Previously cleaned glassware is rinsed with acetone prior to use.

2.5.3.3.3 A solvent blank must be run at the same time as the debris extract. The same volume of acetone used for extraction of the debris should be used for the blank; and the blank should be reduced to the same volume. This blank is compared to the extract from the debris. (Note: It is not necessary to analyze this blank on FTIR unless the FTIR spectrum of the sample extract is consistent with containing explosives or explosive residue.)

2.5.3.3.4 If the sample extract is to be filtered, the blank will be filtered in a like manner.

2.5.3.3.5 If the sample extract is to be evaporated, the blank will be evaporated a like amount.

2.5.3.4 Analytical Procedures

2.5.3.4.1 Rinse the material being extracted with acetone in the areas where residue is observed/suspected.

2.5.3.4.2 Filter the acetone extract, if necessary, using filter paper or a Pasteur pipette with a plug of glass wool inserted into it.

2.5.3.4.3 Decant the acetone into an evaporating dish or beaker and concentrate to several milliliters. Sodium sulfate can be used to remove water from the sample if necessary.

2.5.3.4.4 Transfer to a labeled sample vial.

2.5.3.4.5 Perform microchemical analysis on acetone extract using the following reagents as a minimum:

- Diphenylamine
- Acetone and 2N NaOH
- Brucine

2.5.3.4.5.1 See Appendix 4: Chemicals and Reagents for what constitutes a positive result for each reagent.

2.5.3.4.6 Analyze extract using the appropriate instrumentation. If microchemical tests are negative, no further instrumental analysis is required.

2.5.4 Water Extraction

2.5.4.1 Purpose

The purpose of a water extraction is to remove any inorganic explosives or explosive residues or sugar(s) from the material being extracted.

2.5.4.2 Minimum Standards and Controls

2.5.4.2.1 Previously cleaned glassware is rinsed with deionized water prior to use.

2.5.4.2.2 A solvent blank must be run at the same time as the debris water extract. The same volume of water used for extraction of the debris should be used for the blank; and the blank should be reduced to the same volume. This blank is compared to the extract from the debris.

2.5.4.2.3 If the sample extract is to be filtered, the blank will be filtered in a like manner.

2.5.4.2.4 If the sample extract is to be evaporated, the blank will be evaporated a like amount.

2.5.4.3 Analytical Procedures

2.5.4.3.1 Rinse the material being extracted with D.I. water in the areas where residue is observed/suspected.

2.5.4.3.2 Filter the D.I. water extract, if necessary, using filter paper or a Pasteur pipette with a plug of glass wool inserted into it.

2.5.4.3.3 Filter the portion of the D.I. water extract to be used for IC analysis using Acrodiscs, or their equivalent.

2.5.4.3.4 Decant the water into an evaporating dish or beaker. Concentrate sample and blank if necessary. A portion of the extract and an equal amount of the blank is evaporated to dryness.

2.5.4.3.5 Transfer the liquid extract to a labeled sample vial and any dried residue to a suitable container.

2.5.4.3.6 Perform microchemical analysis on extract using the following reagents as a minimum:

- Diphenylamine (extract must be taken to dryness)
- Silver Nitrate plus NH_4OH
- Triphenylselenium chloride (while supplies last)
- Barium Chloride plus HOAc
- Nessler′s
- 1-Naphthol

2.5.4.3.6.1 See Appendix 4: Chemicals and Reagents for what constitutes a positive result for each reagent.

2.5.4.3.7 Analyze extracts using the appropriate instrumentation. If all microchemical tests are negative, the extracts may be analyzed by IC and SEM/EDS. If any microchemical tests are positive, the samples should be analyzed by IC, SEM/EDS, and XRD. If there is not sufficient dried residue from the extract for XRD analysis, the residue should be analyzed by FTIR.

2.5.5 Toluene Extraction

2.5.5.1 Purpose

The purpose of a toluene extraction is to remove free sulfur present in the material being extracted.

2.5.5.2 Minimum Standards and Controls

2.5.5.2.1 Previously cleaned glassware is rinsed with toluene prior to use.

2.5.5.2.2 If the sample extract is to be filtered, the blank will be filtered in a like manner.

2.5.5.2.3 A solvent blank of the same volume as the sample extract must also be evaporated to dryness. Residue present in the evaporated blank should be compared with the sample residue.

2.5.5.3 Analytical Procedures

2.5.5.3.1 Rinse the material being extracted with toluene in the areas where residue is observed/suspected.

2.5.5.3.2 Filter the toluene extract, if necessary, using filter paper or a Pasteur pipette with a plug of glass wool inserted into it.

2.5.5.3.3 Decant the toluene into a beaker and evaporate to dryness.

2.5.5.3.4 Perform microchemical analysis on a portion of the residue using pyridine and NaOH.

2.5.5.3.5 If the microchemical test is positive, analyze the extract using SEM/EDS or XRD.

2.6 Microchemical Spot Tests

2.6.1 Purpose

Microchemical spot tests are used as a screening method for compounds or ions commonly found in explosives or explosive residue.

2.6.2 Safety Considerations

2.6.2.1 Care should be taken to minimize exposure to these reagents. The process may be carried out in a well-ventilated area or by using a "Nederman" point-of-use vent, if one is available.

2.6.2.2 Keep the quantity of reagent used to a minimum.

2.6.3 Minimum Standards and Controls

2.6.3.1 Reagents are tested with appropriate controls, specified in Appendix 4, when being used for casework.

2.6.3.2 Reagent blanks are run using those microchemical spot tests that gave a positive result for the sample.

2.6.4 Analytical Procedures

2.6.4.1 Place sample to be tested in a spot plate or in a test tube.

2.6.4.2 Add reagent to the sample.

2.6.4.3 Record any reaction, or lack thereof, while observing under stereo microscope.

2.6.4.4 Refer to the chart of common spot test reactions, Reference 2.6.5.3.

2.6.5 References

2.6.5.1 Anger, V., and Feigl, F., Spot Tests in Inorganic Analysis, ed.6., Elsevier Publishing Company: Amsterdam, The Netherlands, 1972.

2.6.5.2 Jungreis, Ervin, Spot Tests Analysis, John Wiley and Sons, Inc.:New York, New York, 1985.

2.6.5.3 Parker, R.G., Stephenson, M.O., McOwen, J.M., and Cherolis, J.A., "Analysis of Explosives and Explosive Residues. Part I: Chemical Tests", Journal of Forensic Sciences, Vol. 20, No. 1, January 1975, pp. 133-140.

2.6.5.4 Yinon, Jehuda and Zitrin, Shimuel, Modern Methods & Applications In Analysis of Explosives, John Wiley & Sons, Inc.: NY, NY, 1993.

2.7 Ignition Test

2.7.1 Purpose

The purpose of the ignition test is to determine how the suspected explosive powder behaves when ignited.

2.7.2 Safety Considerations

2.7.2.1 Only use a small amount of material.

2.7.3 Minimum Standards and Controls

2.7.3.1 The examiner should have observed ignition tests of known explosives prior to conducting the test on the case sample(s).

2.7.4 Analytical Procedures

2.7.4.1 A small portion of the sample is held over a flame using either forceps or a spatula.

2.7.4.1.1 If trace amounts of sample are present, then the examiner may elect to not conduct this test.

2.7.4.2 An alternate method is to place some of the sample on a tissue in an evaporating dish. The tissue is ignited.

2.7.4.3 The reaction as the flame contacts the sample is noted and recorded.

2.7.5 References

2.7.5.1 Yallop, H.J., Explosion Investigation, The Forensic Science Society & Scottish Academic Press, Harrogate, England and Edinburgh, Scotland, 1980.

2.7.5.2 Yinon, Jehuda and Zitrin, Shimuel, Modern Methods & Applications In Analysis of Explosives, John Wiley & Sons, Inc.: NY, NY, 1993.

2.8 Instrumental Analysis

2.8.1 FTIR

The FTIR is used in conjunction with other analytical techniques to identity the functional groups present in the explosive powder or residue.

2.8.2 IC

The IC is used in conjunction with other analytical techniques to identify the sample cations and anions in solution.

2.8.3 XRD

The XRD may be used alone or in combination with other analytical techniques to identify chemical compounds present in powders exhibiting crystalline structures.

2.8.4 SEM-EDS

The SEM/EDS is used to identify the elemental composition of solid samples or dried extracts.

2.8.5 GC-MS

The GC/MS is used for the identification of compounds from their chemical structures.

2.8.6 References

2.8.6.1 Weiss, Joachim, Handbook of Ion Chromatography, Dionex Corporation:Sunnyvale, CA, 1986.

2.8.6.2 Yinon, Jehuda and Zitrin, Shimuel, Modern Methods & Applications In Analysis of Explosives, John Wiley & Sons, Inc.: NY, NY, 1993.

2.8.6.3 Yinon, Jehuda and Zitrin, Shimuel, The Analysis of Explosives, Pergamon Press Ltd., Oxford, England, 1981.

2.8.6.4 Gabriel, B.L., SEM: A User's Manual for Materials Science, American Society for Metals, Metals Park, OH, 1985.

2.9 Documentation

As a minimum, each case file will include an Explosives Worksheet(s), appropriate instrument condition sheets and hard copies of instrumental data with associated standards.

2.9.1 FTIR spectra will be printed as follows:

- X-axis limits, with the microscope accessory: 4000 cm^{-1} to 650 cm^{-1} ; with the bench: 4000 cm^{-1} to 400 cm^{-1}
- The spectrum will take up the maximum amount of space on the page as is possible
- One spectrum per page
- Any standards generated will be printed in the same manner as the case samples

2.9.2 FTIR spectra will be labeled as follows:

- FS Lab #, Item # and how prepared (e.g., diamond cell, KBr pellet, liquid, vapor, etc.)
- Note if acquired with the bench or microscope (this may appear in the case notes in lieu of on the individual spectrum)
- Date and time
- Filename (optional)

2.9.3 Hard copies of IC data must note if sample has been diluted and by how much.

2.10 Report Wording

The following information should be included in the body of the report whenever possible:

2.10.1 A description of the (reconstructed) device. Include measurements, the initiating mechanism, any labeling or markings, the container's composition, any anti-personnel material, and a description of any other material attached or associated with the device.

2.10.1.1 The Item 1 device consisted of a metal pipe approximately 10 inches long with an outer diameter of approximately 1inch. Black electrical tape was wrapped around the pipe's attached endcaps. A hole in the center of one of the endcaps contained a 3 inch piece of 1/8 inch, green pyrotechnic safety fuse.

2.10.1.2 The Item 1 expended device contained an approximately 1/8 inch hole in the side of the length of the pipe which may have served _____.

2.10.1.2.1 If there is evidence of a fuse, complete the sentence with: may have served as a fuse hole.

2.10.1.2.2 If there is no indication of a fuse, complete the sentence with: may have served to accommodate the source of ignition.

2.10.1.3 Other device measurement examples:

2.10.1.3.1 Approximately 3 inches in length and ½ inch in diameter.

2.10.1.3.2 The approximate measurements of the pipe were 3 inches in length and ½ inch in diameter.

2.10.1.3.3 The expended device was constructed of a 3/4 inch pipe approximately 12 inches in length.

2.10.2 A description of the explosive filler:

2.10.2.1 The Item 1 silver-grey powder was identified as flash powder.

2.10.2.2 Particles recovered from Item 1 were identified as a black powder substitute physically and chemically consistent with Pyrodex®.

2.10.2.3 Particles recovered from Item 1 were identified as smokeless powder. No further testing was conducted following a discussion with Investigator Smith on May 6, 2002.

2.10.2.4 An extract of the Item 1 pipe was chemically consistent with that expected form deflagrated black powder.

2.10.2.5 An extract of Item AB was chemically indicative of deflagrated black powder. Sample condition precluded a more definitive determination.

2.10.3 A description of how the explosive filler would react if properly confined and/or ignited. **This statement is not necessary when the device has functioned.**

2.10.3.1 Properly confined and ignited black powder will explode.

2.10.4 When no explosives are identified, the following statement should be used:

2.10.4.1 No explosives or explosive residue were identified in the Item ___ extracts.

2.10.5 For chemical reaction bombs:

2.10.5.1 Unexpended device:

- Item ____ consisted of an intact, capped bottle containing liquid. The liquid was consistent with containing hydrochloric acid and aluminum.

2.10.5.2 Expended device:

- The Item _____ materials were physically and chemically consistent with an expended chemical reaction bomb employing a capped plastic bottle containing hydrochloric acid and aluminum (foil).

2.10.5.3 Physical and chemical evidence of a chemical reaction bomb with no bottle submitted:

2.10.5.3.1 The Item _____ material was physically and chemically consistent with that expected from an expended chemical reaction bomb containing hydrochloric acid and aluminum foil. It should be noted that a properly confined mixture of hydrochloric acid and aluminum can produce a sufficient amount of gas to explode.

2.10.5.3.2 Items _____ and _____ exhibited damage consistent with that expected from a chemical reaction bomb. Based upon the results described above, no further examination was necessary on these Items.

2.10.5.4 For non-aqueous chemicals such as "crystal" drain cleaners:

- It should be noted that a properly confined mixture of sodium hydroxide, water and aluminum can produce a sufficient amount of gas to explode.

2.10.6 For dry ice bombs:

The Item 1 spent device was physically and chemically indicative of, but not limited to, that expected from dry ice bottle bombs.

It should be noted that properly confined dry ice, a solid form of carbon dioxide, can produce a sufficient amount of gas to explode.

2.10.7 1/16 inch or 1/8 inch typical green fuse material will be referred to as: pyrotechnic safety fuse.

2.10.8 If specifying a brand of black powder substitute in a report, the following superscripts are to be used:

Pyrodex®
Clean Shot Powder™
Black Canyon Powder™
Clear Shot Powder™
Golden Powder™
Black Mag Powder™

♦End